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THE AGRICULTURAL SITUATION FOR 1918

A SERIES OF STATEMENTS PREPARED UNDER THE DIRECTION OF THE SECRETARY OF AGRICULTURE

PART II

DAIRYING

DAIRY PRODUCTION SHOULD BE MAINTAINED

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WASHINGTON, JANUARY 31, 1918

PUBLICATIONS OF THE DEPARTMENT OF AGRICULTURE RELATING TO DAIRY ANIMALS AND DAIRY PRODUCTS.

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206. Milk Fever and Its Treatment.
350. Dehorning of Cattle.
351. Tuberculin Test of Cattle for Tuberculosis.
355. A Successful Poultry and Dairy Farm.
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623. Ice Houses and Use of Ice on Dairy Farms.
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743. Feeding of Dairy Cows.
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Spilled Milk, Do Not Cry Over It. Stop It. (Poster.)
Skimmed Milk for Human Food. (A-1-31.)
Feed More Legumes—Less Grain—to Dairy Cows. (A-1-25.)
The Manufacture of Cottage Cheese in Creameries and Milk Plants. (A-1-19.)
Ways to Use Cottage Cheese. (A-1-18.)
Ten Suggestions For Milk Consumers.
The Value of American Cheese. (A-1-21.)
Silage—Canned Corn—No Tin Needed. (A-1-23.)
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Cottage Cheese, An Inexpensive Meat Substitute. (A-1-24.)
Buttermilk and Artificial Buttermilk.
Milk As a Food. (A-1-27.)

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IMPORTANCE OF DAIRYING.

THE SHIFTING DEMANDS due to the war have called for important changes in the dairy industry. Dairying is one of the largest of the agricultural enterprises of this country and the demands upon it will be in proportion to its importance. Dairy products are essential to the well-being of the Nation, and every effort should be expended to maintain the supply in this country and, so far as possible, to meet the increasing demands of the Allies.

EXPORTS INCREASE AND IMPORTS DECREASE.

Before the war the United States received dairy products from no fewer than 24 foreign countries; now these supplies have been largely stopped and it has become necessary not only to replace them at home but also to export large quantities. During the year ended June 30, 1916, exports of dairy products were valued at about 24 million dollars, with imports for the same period amounting to about 11 million dollars. At the end of the succeeding year, June 30, 1917, our exports had increased in value to about 49 million dollars and imports had shrunk to about 9 million dollars. Thus in one year the trade balance increased from 13 million dollars to 40 million dollars.

The greatest single item of our dairy exports is condensed milk, which now is meeting an unprecedented demand for both army and civilian consumption abroad. In 1914 the imports and exports of this commodity were about equal; that is, we imported about the same quantity we exported. Neither was a very important item in our trade. In 1917, however, exports of condensed milk increased more than 20 times, while imports remained at about the same level as before. (Figs. 1 and 2.)

In the period before the war the major part of the dairy imports consisted of fancy cheese from Italy, Holland, France, Greece, and Switzerland. During 1914, 63,784,313 pounds of cheese were imported, while exports consisted of 2,427,577 pounds. In the fiscal year 1917

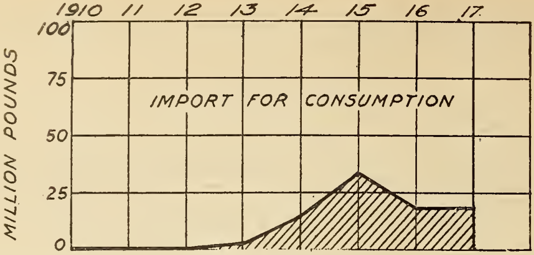

FIG. 1.—Imports of condensed milk, fiscal year ended June 30.

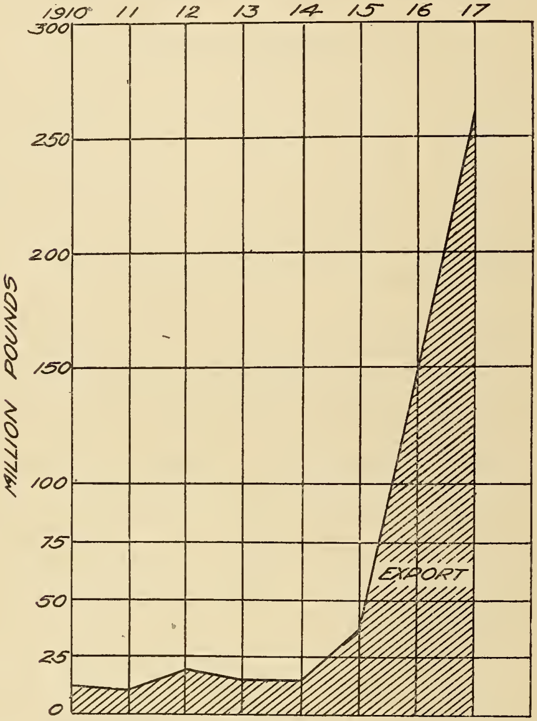

FIG. 2.—Exports of condensed milk, fiscal year ended June 30.

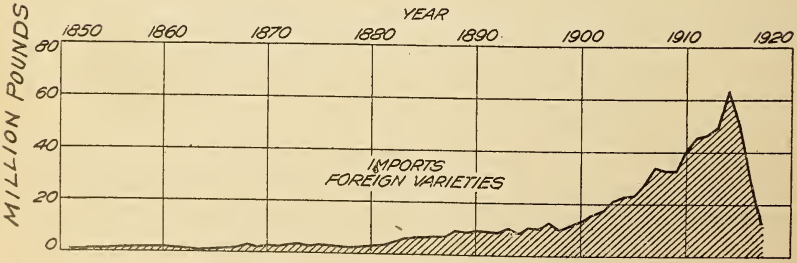

FIG. 3.—Imports of cheese, fiscal year ended June 30.

the imports of cheese dropped to 14.481.514 pounds, while exports rose to 66,087,213 pounds. (See fig. 3 and table of imports and exports. See also figs. 4 to 8 for dairy statistics.)

Total imports and domestic exports of dairy products for the fiscal year ended June 30, 1917.

[Monthly Summary, Department of Commerce.]

Item.	Imports.		Exports (domestic).	
	Pounds.	Value.	Pounds.	Value.
Butter	523,573	$192,767	26,835,092	$8,749.170
Cheese	14,481.514	4,465,633	66,087,213	15,244,364
Condensed milk	18,375,698	1,462,468	259,102,213	25,129,983
Casein	12,319,111	1,843,492	a	
Cream gals	743,819	666,267	b	b 283,467
Milk, fresh		283,978	c	
Total		$8,914,605		$49,406,984

Foreign dairy products re-exported.

Item.	Pounds.	Value.
Butter	2,610	$716
Cheese	169,946	55,718
Milk, fresh and condensed		833.344
Total		$889,778

a None given. b Cream and all other. c Included in cream.

FOOD VALUE OF MILK NOT FULLY APPRECIATED.

Among the country's industries a selection is being made of those most fundamental to a Nation at war. Even some foods are much more vital at this time than others. The foods that are essential in the diet and those that are economically produced must be maintained or increased. Milk is a food that not only contains all the elements necessary for the growth and maintenance of the body but also combines them in the proper proportions and is economically produced, as will be shown later. Milk of average quality has a composition about as follows:

Water	per cent	87.0
Protein	do	3.3
Fat	do	4.0
Carbohydrates (sugar)	do	5.0
Ash	do	0.7
Energy or fuel value per pound	calories	315

All the various constituents are of value. The protein is used by the body to build up and repair such tissues as the muscles and tendons, and to supply certain materials for the blood and other body fluids. Protein is sometimes termed "the flesh or muscle former." It can also be used in the body as energy or fuel, for which purpose it is about as useful as the carbohydrates. The fat and the carbohydrates are the chief sources of energy to carry on the functions of the body, to keep it warm and to be stored as a reserve supply of fuel. For that purpose the fats are worth two and a quarter times as much as the carbohydrates. The mineral matter or ash in foods is also of considerable importance, as from it are formed the bones and teeth and some of it is also present in tissues and fluids. Recent investigations in nutrition have indicated that the ash is of much more importance in human diet than formerly was supposed.

Milk is one of the most economical of foods, as is well shown in the following table, giving the quantities of various foods needed to supply as much protein or energy as 1 quart of milk:

Comparison of milk and other foods as sources of protein and energy.

PROTEIN.	ENERGY.
1 quart of milk is equal to—	1 quart of milk is equal to—
7 ounces of sirloin steak.	11.3 ounces of sirloin steak.
6 ounces of round steak.	14.9 ounces of round steak.
4.3 eggs.	9 eggs.
8.6 ounces of fowl.	14.5 ounces of fowl.

Another method of comparison is shown by the table below, in which the relative values of certain foods as economical sources of protein are given. According to this table, if milk is selling at 12 cents a quart, sirloin steak must sell as low as 27.4 cents a pound or eggs at 33.5 cents a dozen to supply protein at equal cost.

Protein value of milk.

Milk at—	Is as cheap as sirloin steak at—	Or eggs at—
7 cents a quart	16.0 cents a pound	19.6 cents a dozen
8 cents a quart	18.3 cents a pound	22.3 cents a dozen
9 cents a quart	20.6 cents a pound	25.1 cents a dozen
10 cents a quart	22.9 cents a pound	27.9 cents a dozen
12 cents a quart	27.4 cents a pound	33.5 cents a dozen
15 cents a quart	34.3 cents a pound	41.9 cents a dozen

The table below shows that milk at 15 cents a quart is a cheap source of energy as compared with sirloin steak and eggs.

Energy value of milk.

To supply energy at equal cost, when milk is—	Sirloin steak must not be more than—	And eggs not more than—
7 cents a quart	9.9 cents a pound	9.3 cents a dozen
8 cents a quart	11.3 cents a pound	10.7 cents a dozen
9 cents a quart	12.8 cents a pound	12.0 cents a dozen
10 cents a quart	14.2 cents a pound	13.3 cents a dozen
12 cents a quart	17.0 cents a pound	16.0 cents a dozen
15 cents a quart	21.2 cents a pound	20.0 cents a dozen

In comparing foods it is necessary to consider both the protein and the energy furnished. Neither one can properly be used alone as a basis of comparison, nor is there any correct way to reckon the value of a food by considering the total amount of nutri-

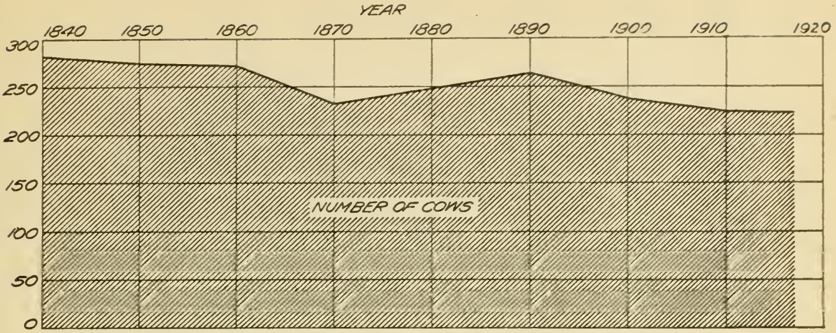

FIG. 4.—Milk cows in the United States per 1,000 population.

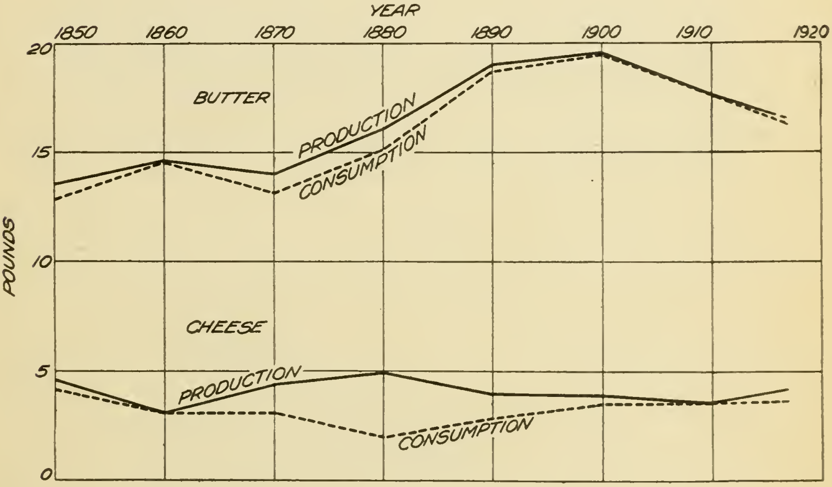

FIG. 5.—Per capita production and consumption of butter and cheese in the United States.

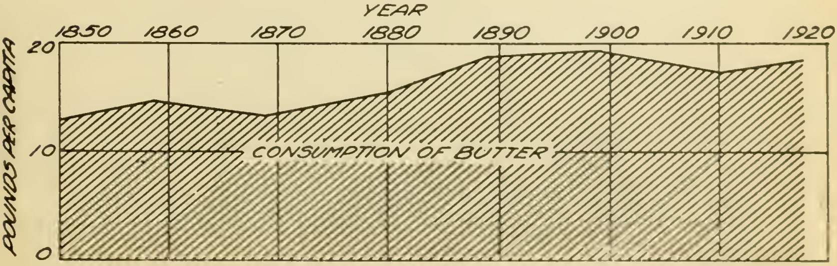

FIG. 6.—Per capita consumption of butter in the United States.

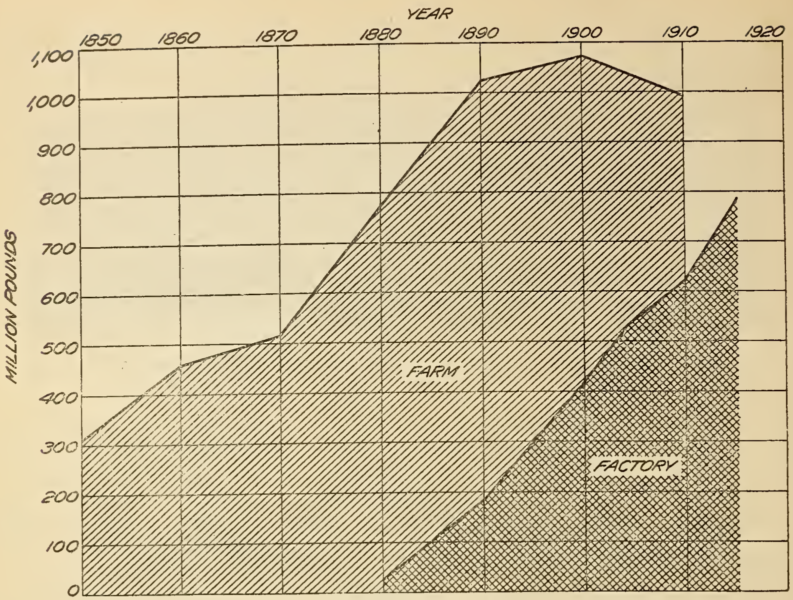

FIG. 7.—Butter production in the United States. To obtain the total butter produced, the farm butter must be added to that made in the factory. In 1910 the total butter produced amounted to more than 1,600,000,000 pounds.

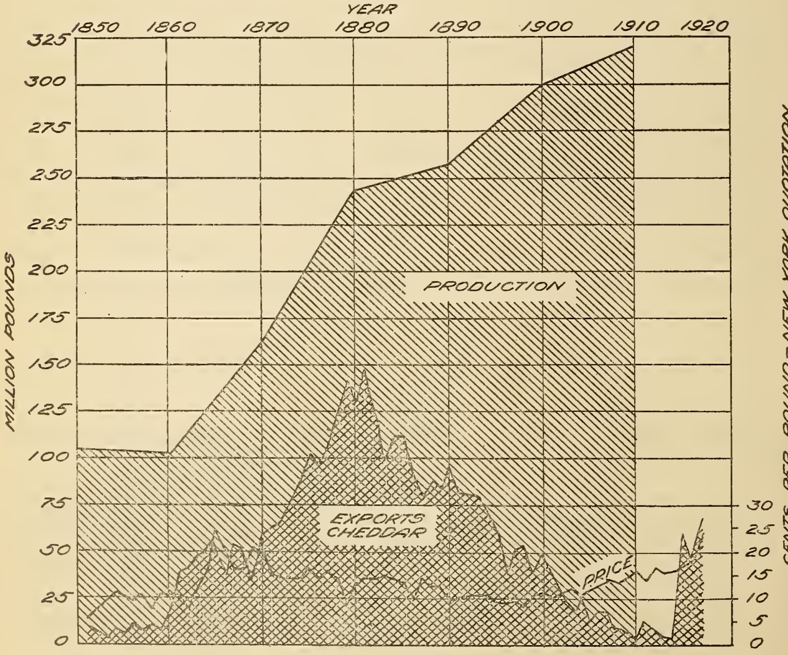

FIG. 8.—Total production of cheese in the United States, and exports and average price of Cheddar cheese.

tive elements. It is very difficult to compare foods on the basis of the mineral matter they contain, but all physiologists agree that milk is extremely valuable in that respect. Indeed, it is the food prepared by nature especially for the growth and development of the young, and contains an abundance of the minerals so much needed. A quart of milk a day is a good allowance for a young, growing child. In addition to being an economical food, milk is usually well digested and requires no cooking or other preparation for the table.

MILK IN THE DIET.

In the food consumed by the average family milk and its products furnish 20 per cent of the heat units; in fact, scarcely a meal is served without some dairy product. It is doubtful whether there is a more widely used food in the world than milk or some of its products.

IMPORTANCE OF MILK FOR CHILDREN, INVALIDS, AND WOUNDED.

Babies who can no longer be nursed by their mothers are forced to depend upon cows' milk as a substitute. Children, invalids and the wounded also depend to a great extent upon milk for nourishment. Being a liquid, it is easily taken by both the very young and the sick, when often solid foods can not be used. In milk are found certain substances, sometimes called vitamins, necessary for growth, which make milk vitally important for children, invalids and wounded. For that reason children who require growth-producing foods, and invalids whose bodies have to combat disease and repair wastes, require milk.

NEED OF ANIMAL FOOD.

It has been found that such animal food as milk, eggs, and meat contains these growth-producing substances in quantities sufficient for the rapid growth and development of the body. While these substances are found in certain vegetables and grains, they are in quantities so small that often in the ordinary diet sufficient quantities are not consumed to meet the needs of the growing body.

THE DAIRY COW AN ECONOMICAL PRODUCER OF ANIMAL FOOD.

Two facts stand out prominently as reasons for the increased production and use of milk. The first is that milk as purchased on the market usually supplies food material together with the growth-producing elements more economically than either meat or eggs. The second reason is that the dairy cow is the most economical producer of animal food. One great law of food conservation is to turn inedible feeds into edible foods in the cheapest possible manner. The dairy cow will utilize coarse materials, inedible by humans, such as grass, cornstalks, hay, etc., and will turn them into milk, which is suitable for human food. Other farm animals also are converters of coarse roughage into edible foods, but are not so efficient as the dairy cow.

According to Jordan* different animals produce the following quantities of edible solids for every 100 pounds of digestible organic matter consumed:

Edible solids produced per 100 pounds of digestible organic matter consumed by different farm animals.

Animal.	Edible solids produced.	Animal.	Edible solids produced.
	Pounds.		*Pounds.*
Cow (milk)	18.0	Poultry (eggs)	5.1
Pig (dressed)	15.6	Poultry (dressed)	4.2
Cow (cheese)	9.4	Lamb (dressed)	3.2
Calf (dressed)	8.1	Steer (dressed)	2.8
Cow (butter)	5.4	Sheep (dressed)	2.6

SOME ADVANTAGES OF DAIRYING.

A few of the many advantages of dairying are given below:

1. The sale of dairy products furnishes a steady income throughout the year. The farmer who depends upon crop sales for his income usually makes the bulk of his sales during one or two months of the year, while during the rest of the year he has no cash income. Such a system requires long credits in the community.

2. The market for dairy products fluctuates very little year by year as compared with other farm products.

3. Through the return of manure to the land the fertility and physical condition of the soil may be maintained at a high level and crops increased. Even after many years a properly maintained dairy farm has constantly increasing crop yields instead of decreasing ones.

4. In dairying, labor may be utilized at a more uniform rate throughout the year than in nearly any other farm business. The grain grower, for example, may have to employ much additional labor at harvest time, but so far as the dairy is concerned the dairyman has about the same duties to perform every month of the year. Thus less help is required seasonally and permanent employees may be kept.

5. Through the dairy cow many unsalable roughages may be transformed into products from which cash may be realized. Grass, hay, corn-fodder, and other roughage which may not have a ready sale are economically utilized by the dairy cow. Land which is not suitable for cultivation can be utilized for pasturage for dairy cows.

HOW TO INCREASE PRODUCTION.

The primitive cow freshened in the spring and produced milk enough to feed her calf until it could forage for itself. The improved dairy cow of to-day is a highly specialized animal that freshens at the time desired and that produces a large flow of milk during from 9 to 12 months of the year. How to obtain this large production most economically is the great problem of every dairyman. Economical production depends primarily on selection, breeding and feeding, care and management. It requires that all unprofitable cows be eliminated, that the remainder be bred to first-class bulls, and that each cow in the herd be fed a properly balanced ration according to production. It also requires the intelligent feeding, care, and management of calves and young stock.

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* Jordan, W. H., The Feeding of Animals. New York, 1912.

INCREASE THROUGH SELECTION.

The war has greatly increased the demand for dairy products, and it is also important that they be produced economically. In order that the quantity of dairy products may be large and the production economical, more and better cows are needed. The raising of all the best heifer calves will provide cows enough to permit the culling out of all low producers.

Every owner of dairy cows should establish a definite standard, and all cows that do not measure up to the requirements should be disposed of for beef. Whether a dairy cow should be rejected or retained should depend ordinarily on production, as shown by the milk scales and the Babcock test.

Farmers who are too busy to test their own cows may now have this work done for them at nominal cost by joining a cow-testing association. Such an association ordinarily is an organization of about 26 dairy farmers who cooperatively employ a man to keep records of their cows. The tester spends one day each month with each member, tests and weighs the milk for butterfat, weighs the feed, both concentrates and roughage, and advises the farmer concerning the quantity and kind of feed to be given each cow in the herd. From the quantity of milk, the butterfat test and the cost of feed, he helps the farmer to determine which cow should be rejected. He also aids in the selection of calves, in improving the sanitation of the barn, milk house and dairy utensils, and in many other ways assists in lifting the dairy business to a higher level.

There are now 472 cow-testing associations in the United States, and last year monthly records were kept for 216,831 cows, or about 1 per cent of all the dairy cows in this country. The cows in the associations whose records have been tabulated averaged 247 pounds of butterfat, or about 50 per cent more than the average production of all the dairy cows in the United States. If all the dairy cows in the country could be brought up to the average of the cow-testing associations, production would be increased 50 per cent in quantity and the cost of production would be considerably reduced.

BETTER BREEDING HELPS.

Large production and profit go hand in hand. Breeding furnishes the most economical way to obtain large-producing cows. The purebred bull, with generations of high-producing ancestors back of him, must be used for breeding, and only the best heifers from the best cows should be chosen to be the dams of the next generation. Pure breeding alone does not make a good sire. The pure-bred sire should come from a long line of high-producing ancestors. If an old bull is selected he should have high-producing daughters. Two courses are open to the dairyman when buying a herd bull: he can purchase a young bull from a good, milk-producing stock, or he can purchase an old and tried bull. In either case the bull should be healthy and from a herd free from disease; he should have a good constitution and be of good conformation. In selecting a young bull the buyer should choose one whose female ancestors have uniformly high records of production, since this indicates that high production is a fixed characteristic of the family. Careful attention should be given to the record of the young bull's dam, and after that to the daughters of his sire. The records of closely related animals are of far more importance than the fact that the pedigree may include, three or four generations back, some exceptionally high-producing animals.

The tried and proved bull is the best investment. When a bull's daughters are larger producers than their dams, he has improved the herd. Many good bulls, however, are sacrificed before their worth can be determined, which means the continual use of young bulls whose real value is not known. The sire should be kept until his daughters have shown his worth, and if he is a herd improver he should be kept in the community as long as he is useful.

The owner of a large herd of cows can well afford to own a first-class bull, and the bull association has now made it possible for the owner of a small herd to own a share in a good, well-bred bull. A cooperative bull association is a farmers' organization whose chief purpose is the joint ownership, use and exchange of high-class, pure-bred bulls. If skillfully managed these associations should be eventually the greatest single factor in the upbuilding of our dairy herds. The typical cooperative bull association is composed of from 15 to 30 farmers. It jointly owns 5 bulls, and divides its territory into 5 breeding blocks, to each of which one bull is assigned. As many as 50 or 60 cows may belong to the farmers in each block, and the bull should be kept at some farm conveniently situated. The blocks are numbered from 1 to 5 and to prevent inbreeding each bull is moved to the next block every two years. If all the bulls live and if all are kept until each has made one complete circuit, no new bulls need be purchased for 10 years. In that way, by paying only a small part of the purchase price of one bull, each member of the association has the use of good, pure-bred bulls for many years. In one association having more than 100 members the original cost to each was only $23. In another association of 50 members the average investment was $25. It is possible for each association to continue for 10 years or more without other additional cost than the maintenance of the bulls.

Most of the milk in the United States is produced in small herds containing four or five grade cows. Pure-bred bulls are comparatively few in number, and expensive. It is, therefore, impossible for each dairyman with a small herd to own a pure-bred bull. Because of the expense it would also be impracticable to buy such a bull for a small herd. It would further be uneconomical to limit the use of a good bull to a few cows, when his use could be extended to a greater number of cows. If pure-bred bulls could be used in all the grade herds, in a single generation all the offspring would be at least half pure-bred and would show immense improvement. By means of the bull associations it is possible for small herds to have the advantages of good, pure-bred bulls at the minimum of cost.

On account of the present emergency it is particularly important that good bulls should be utilized to the fullest advantage, for more can be accomplished in increasing production and making it more economical in this way than in any other.

The results of cooperative bull-association work are most encouraging. Of the 17 daughters of bulls in one association, 16 excelled their dams. The average production of the daughters was 1,145 pounds more milk than their dams, and 26.7 per cent more butterfat.

DAIRY CALF CLUBS ARE HELPFUL.

In the calf club an effort has been made to centralize the energy of the boys and girls in raising and caring for dairy calves. The objects of the calf club are many; the chief one, however, is to develop in the boys and girls a desire to engage in live-stock husbandry and at the same time teach them the value of thrift. Many plans of organization have been used in these clubs, but the best one seems to be a plan that provides for the calf to be raised by the boy or girl and eventually added to the milking herd of the parent. In this way the juniors are instructed in all the essentials of the raising and caring for calves and dairy cows, and instead of the care of the dairy cattle being a task it becomes a pleasure. The extension departments of the State colleges and also the Department of Agriculture assist in this work.

ECONOMICAL FEEDING MAKES FOR PROFITS.

National necessity during the war requires the greatest economy in the feeding of grain to live stock. Human beings must be fed first, yet milk production must be maintained. That does not mean that our dairy cows should be starved or even that they should be required to live on half rations. This is the very time when they should be fed, and well fed, in order to maintain sufficient supplies of dairy products for our own armies and the armies of our Allies, and still have enough for our civilian population. In order to feed the dairy herds well, with the minimum of grain, substitutes must be furnished for at least part of the grain. With a good pasture during the entire summer and with rich corn silage and first-class legume hay for winter feeding, good dairy cows will yield a heavy flow of milk at a minimum of cost. Clover, alfalfa, cow-pea, soy-bean, velvet-bean or other legume hay, when fed with good silage, will maintain a medium production of milk at a relatively low cost. Under ordinary farm conditions it is not to be expected that legume hay will take the place of the entire grain ration, but if it is substituted in part, large quantities of grain will be released for human food.

The first step in bringing this condition about must be the planting of more legumes, and the sooner it is done the better it will be for the individual dairyman, as well as for his State and the Nation. Every dairy farm should produce, when possible, at least one ton of legume hay for each cow on the place.

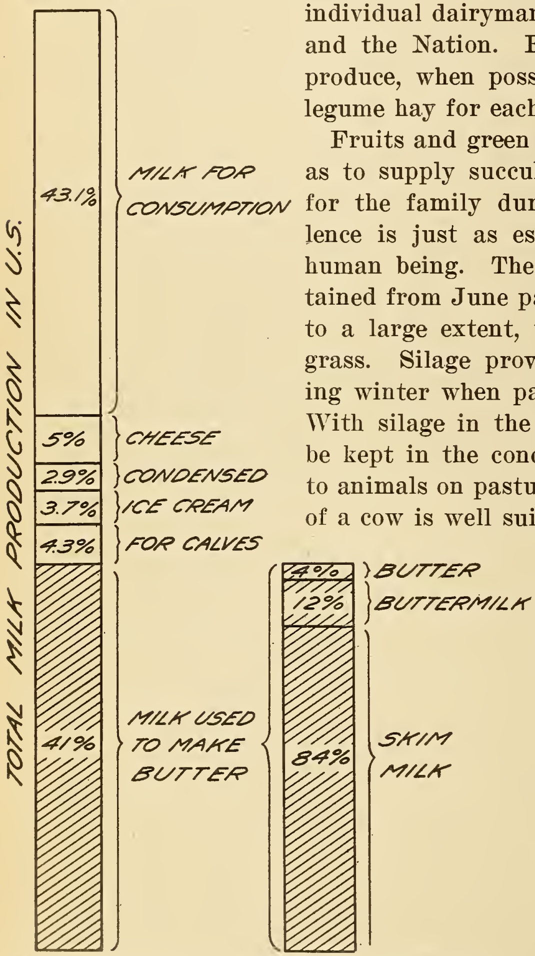

FIG. 9.—Uses to which the total milk produced in the United States is put, shown by percentages. The side chart shows that butter is only 4 per cent of the weight of the milk from which it comes.

Fruits and green vegetables are canned so as to supply succulent and palatable foods for the family during the winter. Succulence is just as essential to cows as to a human being. The abundant milk flow obtained from June pasturage probably is due, to a large extent, to the succulence of the grass. Silage provides succulent feed during winter when pasturage is not available. With silage in the ration, dairy cattle can be kept in the condition of health common to animals on pasture. The digestive system of a cow is well suited for the utilization of large quantities of green grasses and other coarse, succulent material. Silage is palatable, and no other feed will combine so well with dry hay and a little grain to produce maximum economical results.

The preservation of the mature corn crop or the saving of one which for any reason must be harvested before maturity by placing it in silos is deservedly increasing in popularity. About 40 per cent of the total food material in the corn plant is in the stalks and leaves. When only the ears are harvested nearly one-half of the crop is lost; on the other hand, when the crop is put into the silo the losses are very small. When drought, frost or insects attack a field of corn before it is ripe, the entire crop may be lost unless a silo is at hand in which to preserve it.

No feed crops can be so successfully harvested under widely varying conditions as those that are put into the silo. Only in case of drought or frost is it necessary to rush the filling of the silo; rain or dew on the forage does not injure the silage.

BETTER UTILIZATION OF DAIRY PRODUCTS.

Much can be accomplished by breeding and selection, as has been pointed out, but three years will be required before the results of better breeding will affect the milk supply. Better feeding and management also will increase the efficiency of our dairy herds very much more promptly. But, perhaps, one of the biggest factors and one that can be employed at once to meet the great need, will be the fullest utilization of all dairy products and by-products for human food.

The total milk produced in the United States for the year 1917 is estimated to be 84,611,350,000 pounds. This immense quantity is used in a number of ways and in the preparation of several widely different products. It is especially interesting to note in what ways and how completely the milk is utilized. The following table shows estimates for 1917. (See also fig. 9.)

Uses to which milk is put (calculations based on estimates).

Item.	Pounds of milk.	Per cent.
Product of 22,768,000 cows at 3,716 pounds per annum	84,611,350,000	......
Disposition of milk product:		
1,650,000,000 pounds of butter (at 21 pounds milk)	34,663,850,000	41.0
420,000,000 pounds of cheese (at 10 pounds milk)	4,200,000,000	5.0
975,000,000 pounds of condensed milk (at 2½ pounds milk)	2,437,500,000	2.9
210,000,000 gallons of ice cream (weighing 6 pounds to the gallon, 10 per cent fat)	3,150,000,000	3.7
100,000,000 persons; 45 per cent at 0.7 pound a day (cities); farms with dairy cows, 30 per cent, 1.5 pounds per day; other farms and small towns, 25 per cent, 1 pound a day, approximately	36,500,000,000	43.1
17,500,000 calves, whole milk (estimated) requirement	3,660,000,000	4.3
Total	84,611,350,000	100.0

Although the table accounts for all the milk produced, it does not tell the whole story, since the preparation of a number of products results in the formation of vast quantities of by-products that are not used to the fullest advantage for human food.

HUMAN FOOD IN DAIRY PRODUCTS.

The quantity of solids in the milk and their disposition are shown in the following tabulation, and also in figure 10:

Solids in milk.

	Pounds of solids.
Total milk (1917), estimated	10,999,475,500
Milk consumed	4,745,000,000
Skim milk	2,729,778,000
Butter	1,386,554,000
For calves	475,800,000
Ice cream	409,500,000
Buttermilk	389,968,500
Condensed milk	316,875,000
Cheese	273,000,000
Whey	273,000,000
Total	10,999,475,500

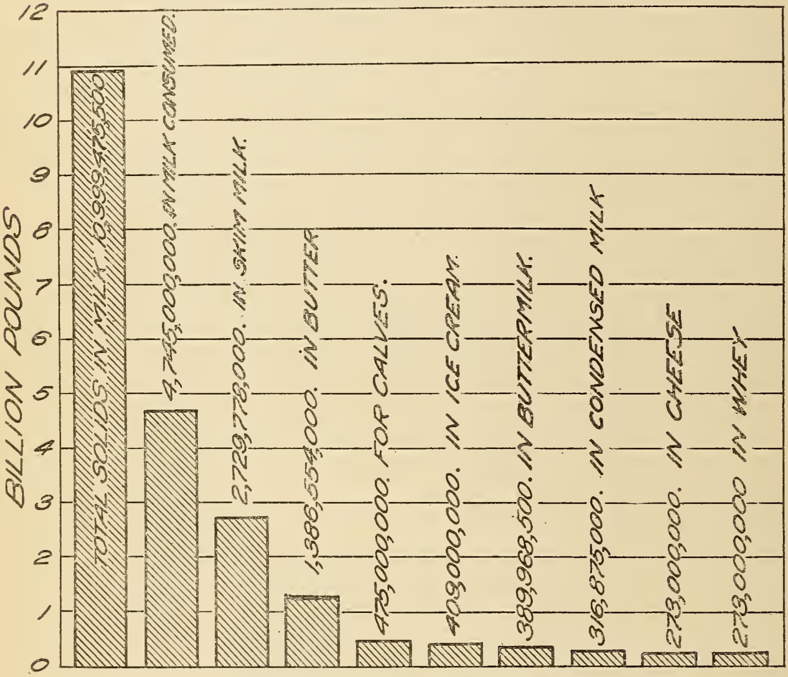

FIG. 10.—Total solids in milk produced in the United States (1917) and the proportion in the different milk products.

The food value of the 84,611,350,000 pounds of milk is great enough to supply daily to every man, woman and child in this country approximately one-fourth as much protein and more than one-fourth as much energy as the body requires. This means that if the milk that is now produced were utilized to the fullest extent it would supply one-quarter of all the food needed by all the people in this country.

Because of the great food value of milk and its products, our attention is directed to the utilization not only of the primary products but of all the by-products. The milk used as market milk and that which is condensed is, of course, wholly utilized as human food.

Few people in this country eat cheese in sufficient quantities for it really to form an important part of the daily fare. Indeed, it is used more often simply as an appetizer or as a seasoning for some other food. Nearly every one relishes good American Cheddar or "store" cheese, but there is an impression that it is indigestible and constipating. Extensive digestion experiments carried on by the Department of Agriculture have demonstrated that more than 95 per cent of the protein of cheese is digested and 90 per cent of its energy is available. Even when eaten in large quantities and for long periods, no case of indigestion, constipation, or other disturbance was observed in those who ate it. One man who ate cheese as the chief source of both protein and energy, eating an average of 9.27 ounces daily, with bread and fruit, for more than two years, did a fair amount of muscular work and kept in good health.

American Cheddar cheese is a very satisfactory substitute for meat. It can be kept in storage for a long time and contains much food in small volume.

The following tables show the value of cheese in comparison with some of the common meats:

One pound of American Cheddar cheese contains as much protein as—
1.57 pounds of sirloin steak.
1.35 pounds of round steak.
1.89 pounds of fowl.
1.79 pounds of smoked ham.
1.81 pounds of fresh ham.

In order to judge the value of foods fairly not only the protein, but the energy also, must be compared. To supply energy, cheese is one of the best of food products.

One pound of cheese supplies as much energy as—
1.98 pounds of sirloin steak.
2.61 pounds of round steak.
2.52 pounds of fowl.
1.17 pounds of smoked ham.
1.29 pounds of fresh ham.

It will be seen from these tables that a pound of cheese supplies more than twice as much energy as a pound of fowl or round steak and almost twice as much protein as the same amount of fowl or ham. Cheese, therefore, is usually a cheaper food than the meats.

In the manufacture of cheese the most valuable solids—fat and casein—are used, but they form only a part of the total solids of the milk. Whey is the by-product of cheese manufacture. A relatively small quantity of whey is used for manufacturing milk sugar, but the demand for that product is limited and it is, therefore, not possible to use whey in that way. The albumin remaining from the manufacture of milk sugar is sometimes used for poultry feed. A little whey is used in making primost, a variety of cheese, which utilizes all the whey solids. Some is also used to make albumin cheese, which utilizes the albumin but not the milk sugar.

With these few exceptions the whey is used as stock feed or is wasted. There seems to be no practicable method of diverting the remainder of this great quantity of whey to channels of human consumption. It is, however, a good feed for hogs and is commonly said to have half the value of skim milk. Being low in protein, whey, unless properly supplemented, is better adapted as feed for older animals than to very young pigs.

In the manufacture of butter only about 4 per cent of the milk goes into the butter, 96 per cent remaining as the by-product in the form of skim milk and buttermilk. The manufacture of ice cream also leaves some skim milk as a by-product. As a by-product of buttermaking alone there are 29,117,634,000 pounds of skim milk, which contain more protein than all the beef consumed in this country in one year. If made into cottage cheese—a product readily used as a meat substitute—the food value compared with beef is as follows:

Skim milk from butter in U. S. (1917, estimated)	pounds	29,117,634,000
Cottage cheese that could be made (15 pounds per 100)	do	4,367,645,100
Protein in cottage cheese (20.9 per cent)	do	912,837,826
Total beef consumed in U. S. (1915)	do	8,292,000,000
Protein in total beef consumed, 1915 (8,292,000,000 X 0.115)	do	953,580,000
Energy in cottage cheese (500 calories per pound)	calories	2,183,822,550,000
Energy in total beef consumed (1530 calories per pound)	do	12,686,760,000,000

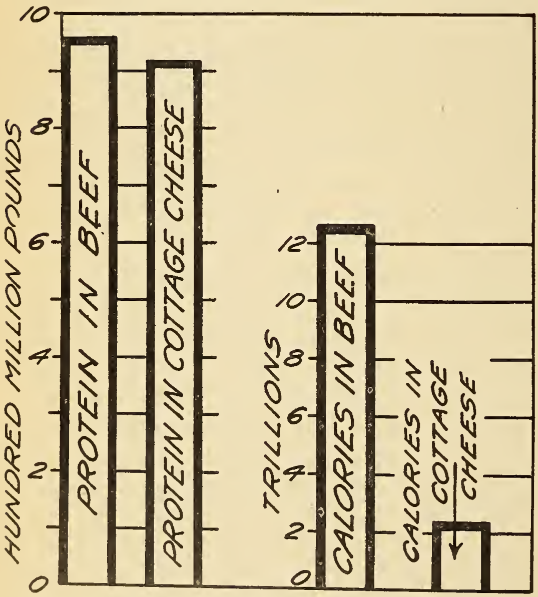

Fig. 11.—Pounds of protein and calories of energy in the cottage cheese that could be made from the skim milk remaining as a by-product of butter-making, compared with the protein and energy supplied by the beef consumed in the United States in one year.

Some of this skim milk is entirely wasted during certain seasons, while the larger part of it is fed to live stock. This by-product is excellent for calves, hogs and chickens, all of which are needed, but only a small part of that now used is necessary for their proper growth and development. The use of more than is necessary in animal feeding is wasteful of human food. The possibilities of increasing the supply of human food by the fuller utilization of this by-product are enormous.

About 300,000,000 pounds of skim milk are condensed; 200,000,000 pounds are made into skim-milk powder; 100,000,000 pounds used for skim-milk cheese, and 600,000,000 pounds used in the manufacture of casein. If we deduct these quantities of skim milk the remainder is still so great that its protein value is nearly equal to all the beef consumed annually. (See fig. 11.)

SKIM MILK NOT UTILIZED TO FULLEST ADVANTAGE.

A certain quantity of milk and skim milk is needed to feed calves, but it is possible to raise them with much less than is commonly fed. In sections that produce whole milk and in some cheese-manufacturing communities the farmers, in their desire to market all the milk possible, have learned to reduce to the minimum the milk and skim milk fed to calves, to wean them at an early age, and to use milk substitutes. Skim milk and buttermilk are excellent feeds for pigs, but except for the very young are not a necessary part of the ration. Pigs can be, and are, successfully raised with little skim milk or buttermilk.

During this world food shortage, in selecting a ration for live stock, the idea to be kept in mind is to use, so far as possible, material that can not be used readily for human foods. Hays and grasses are among the best feeds for pigs and calves to take the place of milk. The pig that has alfalfa pasture has little or no need for skim milk, which is, therefore, readily available for human food.

We need to produce pork and we need to produce meat of all kinds, but we must be able to do it without feeding vast quantities of materials that can be used in their present form more efficiently for human food. In converting skim milk into pork there is a loss of material, as all the nutrients in the skim milk are not recovered in the pork. Some are converted into bone and muscle, some into heat to keep up the body temperature, and some into energy for maintaining the functions of the body. From the standpoint of the world's food supply, it is not economical; it is not right to use, unnecessarily, for stock feed, a food that can be used readily for human beings.

Skim milk may be used to advantage in several ways in the human diet: (1) In its natural state; (2) in the form of condensed skim milk, skim-milk powder, and (3) as skim-milk cheese, either hard or soft. The manufacture of cottage cheese is a simple and economical means of utilizing skim milk by creameries, on the farm and in the city home. From 100 pounds of skim milk 15 pounds of cottage cheese may be made, with a protein value equal to 22.5 pounds of pork. In other words, a quart of skim milk makes more than a third of a pound of cottage cheese. When a hundred pounds of skim milk is fed to a pig the skim milk is converted into about 4.8 pounds of dressed pork, when combined with other feeds to the best advantage. For every hundred pounds of skim milk fed to pigs instead of used for human food in the form of cottage cheese, there is a food loss equivalent to the protein in 17.7 pounds of meat. That is not all; after the manufacture of cottage cheese, the whey remains and is available for stock feed. From 100 pounds of skim milk made into cottage cheese there is a residue of about 80 pounds of whey, which is regarded as having a feeding value of about half that of skim milk, and on that basis, when properly combined with other feeds, will produce 1.9 pounds of pork. So, by making cottage cheese and feeding the whey to pigs, the human food produced from 100 pounds of skim milk has the same protein value as 24.4 pounds of meat, or 19.6 pounds more than when all the skim milk is fed to pigs.

The point has sometimes been made that the creamery patron, because he sells cream only, sells less fertility from his farm than one who sells his whole milk. This is true, of course, but the nitrogen, phosphoric acid and potash removed from a farm by selling the skim milk are usually fully replaced by the legumes and mill feeds that are fed, provided the manure is properly used. It is quite evident then that during the present food emergency the fertility removed by selling milk is a small factor that deserves little consideration so long as the live stock is not sacrificed.

The local creameryman, because of his nearness to the source of supply and his contact with the producer, is in position to do a big work in the matter of food conservation by converting skim milk and buttermilk into human-food products.

WHY MAKE COTTAGE CHEESE?

If a condensary is within reasonable distance the creameryman sometimes can sell his skim milk there. Very few creameries, however, are so situated, and the largest opportunity for the creameryman to divert skim milk and buttermilk into channels of human consumption is by the manufacture of cottage cheese. This product is easy to make and utilizes skim milk and good grades of buttermilk.

Cottage cheese is one of the important meat substitutes. It contains a larger percentage of protein (the chief material for body building) than most meats and furnishes this material at a lower cost. In every pound of cottage cheese there is about one-fifth of a pound of protein, nearly all of which is digestible. Meats, on the other hand, usually contain less protein and besides have a certain waste, such as bone and other inedible material. A pound of cottage cheese daily would supply all the protein required by the ordinary adult engaged in a sedentary occupation.

The following table shows that cottage cheese is much cheaper than most meats in furnishing protein for the diet.

For supplying protein, 1 pound of cottage cheese equals—
1.27 pounds sirloin steak.
1.09 pounds round steak.
1.37 pounds chuck rib beef.
1.52 pounds fowl.
1.46 pounds fresh ham.
1.44 pounds smoked ham.
1.58 pounds loin pork chop.
1.31 pounds hind leg of lamb.
1.37 pounds breast of veal.

In addition to protein, energy for performing body work must be furnished by food. As a source of energy also, cottage cheese is cheaper than most meats at present prices. The following table shows the comparison when energy is considered.

On the basis of energy supplied, 1 pound of cottage cheese equals—
8⅓ ounces sirloin steak.
11¼ ounces round steak.
11¼ ounces chuck rib beef.
10¾ ounces fowl.
5½ ounces fresh ham.
5 ounces smoked ham.
6 ounces loin pork chop.
7⅓ ounces hind leg of lamb.
12¾ ounces breast of veal.

A yield of 15 or more pounds of cottage cheese from 100 pounds of skim milk can readily be obtained, or a mixture of two parts skim milk and one of buttermilk will give the same results. The wholesale price on most established markets varies from 4½ cents a pound during the early summer to 7 cents during the winter, the 1917 prices showing marked increases over former years. When making as much as 800 pounds a day the total cost of manufacture, including labor, coal, power, water, package (tubs), and depreciation on equipment, is from 8 to 10 cents a hundred pounds of skim milk.

It is quite evident that the creameryman is in position to make his patrons a good business proposition. In most sections he can offer them a cash market for their skim milk at a price at least equivalent to the value obtained from feeding to animals.

The creamery that receives only hand-separator cream can do this as well as the one receiving whole milk. If arrangements can not be made to install a separator in the creamery the farmers can continue separating at home and bring the skim milk to the creamery with their cream. The price, of course, must be high enough to repay them for hauling to the creamery. During the summer it is necessary to make deliveries daily, and at least every other day during the winter. In many cases this frequent delivery produces a marked improvement in the quality of the butter, and is an added incentive for undertaking the manufacture of cottage cheese.

In some sections of this country where creameries are in close competition with condensaries or market milk dealers, the success of the creameries, or even their very existence, depends upon the proper marketing of the skim milk.

At creameries in large cities it is usually impossible to get skim milk for cottage cheesemaking, and the manufacture of buttermilk cheese offers certain difficulties. The texture of buttermilk cheese is quite different from that of the regular cottage cheese made from skim milk, and the flavor, of course, depends upon the buttermilk from which it is made. Some buttermilk cheese, however, is successfully marketed, which indicates that there are possibilities for conserving and utilizing buttermilk even where skim milk is not available.

While factories can be of immense service in helping to utilize skim milk more effectively, not 10 per cent of it reaches the factories. The milk is separated on the farm and the cream either sold or made into butter there. The farmer, therefore, has probably the greatest opportunity to make and use cottage cheese. If one-half a pound a week were consumed by each person on farms where cows are kept it could replace considerably more than half a billion pounds of meat in a year. This is more than all the beef that was exported to our Allies last year.

Cottage cheese is a most palatable and nutritious product and is one of the few varieties of cheese that are easily manufactured on a small scale, either on the farm or in the city home. No special equipment is necessary for making small quantities and little time and skill are required.

DON'T LET MILK SPOIL.

After any foodstuff is produced one of the important things is to see that it is put on the market in good shape so that it will keep for a reasonable length of time without loss through spoilage. In this time of need for food every effort should be made to prevent milk from spoiling. Cows should be kept clean and should be milked in clean surroundings into a small-top or covered pail. All utensils which come into contact with the milk should be thoroughly sterilized with steam for at least five minutes, and milk should be cooled promptly to 50° Fahrenheit or less and maintained at that temperature. Whenever these conditions are met, little milk will be wasted. In this time of terrible destruction of human life it is particularly necessary that milk be produced under such conditions as to insure a safe food for babies. This must be done by a decreasing number of men trained to do it. A great task and a great opportunity for dairymen are involved.

THE WAR'S EFFECT ON THE WORLD'S SUPPLY OF DAIRY CATTLE.

Although dairy cattle are economical users of feedstuffs and although they will convert coarse, inedible material into a human food, still they must have some grain for maximum production. When animals convert feeds, such as grain, that can be used direct by human beings, they usually do so at a loss of human food. In times of extreme food shortage, therefore, animals are killed for human food and the grain used directly. In some of the continental countries this policy has been followed because of the lack of feeds and the need of meat. Most of the dairy countries of Europe have depended upon imports for a large part of the grains or concentrates for dairy cattle. This supply has been largely cut off, with the result that in some countries there has been a tendency to decrease the number of animals. Because of these facts, millions of dairy cattle have been slaughtered in Europe since the war began. The lack of milk that has resulted has entailed great suffering in some sections, especially among children. It is important, therefore, that such a situation be prevented in this country so far as possible. If, by economical feeding and the utilization of feeds that are not necessary for humans, the dairymen of this country could conserve their herds until after the war, they would render great service to humanity. With the great number of animals killed in Europe and the increase in the rate of slaughter as the war continues, the food shortage becomes more serious. When the struggle is over it will be impossible to meet at once the demand for milk in the countries where the greatest number of cattle have been killed.

Efforts will be made, of course, to increase the number of dairy cattle, but this requires time—several years, in fact. The supply of grain, on the other hand, can be increased more rapidly, but there will probably be demand upon us for products from the dairy, as well as for foundations for herds, provided we keep our supply of good animals. This should be considered another reason for increasing, or at least maintaining, the herds of dairy cattle in this country.

DUTIES OF DAIRYMEN.

The duties and responsibilities of dairymen are especially important in the maintenance of the dairy industry for the good of the Nation. An opportunity is presented to dairymen to serve humanity by the conservation of dairying. Their part is to use the best methods of breeding and management, feed wisely and economically, and utilize all products to the best advantage. The fuller utilization of by-products for human food brings an added financial return that will do much to help maintain the industry. We are depending upon the ingenuity and efficiency of the American people to play a large part in the winning of the war. This same ingenuity and efficiency must be used in the productive industries as well as in destructive ones. If, after putting into effect the best methods and practices for economy and efficiency, it still is necessary to dispose of dairy cows, the dairymen should endeavor to sell them to other dairymen, better situated, in order that the supply of milk may not be reduced.

On the small farm, and it is from such farms that the bulk of our dairy products come, most of the work is done by the farmer and his family. Would it not be possible on many of these farms to keep one or two or three more cows without great inconvenience? This and increased efficiency will meet the situation. We shall have milk for our babies; we shall maintain our industry; we shall have dairy products for our armies, and, in addition, shall be able to share liberally with our friends across the sea.

INCREASED PRODUCTION THROUGH REDUCTION OF DISEASE.

In an effort to maintain or increase our live-stock supplies, the reduction of the toll taken by disease should not be overlooked. There are a large number of diseases which are very common and which seriously affect the dairy industry. Among these are contagious abortion, tuberculosis, infectious garget, cowpox, cattle-tick fever, etc., which in the past have greatly reduced the milk production of our herds.

Tradition has it that in remedying these conditions the value of preventing and combating disease is in the ratio of 16 to 1; in other words, "an ounce of prevention is worth a pound of cure." As a matter of fact this estimate is too low; probably 160 to 1 would be much nearer the truth. In spite of this fact, however, preventive measures are not so well known or so effective that disease can always be prevented.

In dealing with contagious diseases the basic principle of prevention is to keep carriers of infection away from the herd. Next in importance is maintaining the surroundings in a sanitary condition. Following this, the animal's natural resistance to disease should be increased by natural and occasionally by artificial means. Ordinarily, disease stalks about the country only in the bodies of diseased animals or attached to some intermediate object; these may include healthy or recovered animals, contaminated feed and water, infected cars and pastures, or the shoes or clothing of some inquisitive person who insisted on seeing the diseased stock. Avoiding such diseased animals and keeping healthy ones away from carriers of infection are the important methods of preventing disease.

The lack of immediate action upon the part of the farmer when he discovers animals that show symptoms of disease or sickness often is responsible for the loss not only of his own stock but for that of his neighbors. At this time when every step should be taken promptly to avoid losses and to conserve production, it is all the more important that the farmer with sick cattle should get in touch at once with the local veterinarian or county agricultural agent.